



COMMONWEALTH OF MASSACHUSETTS  
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS  
DEPARTMENT OF ENVIRONMENTAL PROTECTION

# Background Document

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For Proposed Revisions to 310 CMR 60.02,  
Regulations for the Enhanced Motor Vehicle  
Inspection and Maintenance Program, to  
establish the On-Board Diagnostics (“OBD”)  
emissions test and other revisions

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# Background Document

*For Proposed Revisions to 310 CMR 60.02, Regulations for the Enhanced Motor Vehicle Inspection and Maintenance Program, to establish the On-Board Diagnostics ("OBD") emissions test and other revisions*

## **1. Objective of the Revisions: Establish an On-Board Diagnostic Emissions Test**

Every summer, Massachusetts' air exceeds the federal health standards for ozone. During these months, ozone, directly affects the health of one in eight Massachusetts residents. The summer of 2001 was no exception with ozone concentrations at 6 of 15 monitoring sites exceeding the 1-hour standard and 13 of 15 monitors exceeding the new, more protective 8-hour standard. This summer we have had 10 of 15 monitors exceeding the 8-hour standard by the last week of June.

Emissions inventories and modeling show that cars, trucks, and buses are a significant source of the Commonwealth's ozone problem. A disproportionately large part of the vehicle emissions that contribute to the ozone problem come from a small number of vehicles with malfunctioning emission controls.

In 1999 the Department of Environmental Protection (DEP) replaced its vehicle emissions idle test with an enhanced emissions inspection and maintenance program (I&M), as part of DEP's comprehensive plan to improve the state's air quality and as required by the U.S. Environmental Protection Agency (EPA). This new program was based on a dynamometer test, which simulated driving conditions while measuring emissions at the tailpipe. The objective was more accurate identification of those vehicles with malfunctioning emission controls, particularly those that cause excessive NOx emissions, which the idle test could not measure. This test is the most effective available for 1980s and early 1990s vehicles.

These proposed revisions to the enhanced emissions inspection and maintenance (I&M) program are designed to take advantage of advances in vehicle technology. They would establish an emissions test using a vehicle's own on-board diagnostic (OBD) system for newer light duty cars and trucks (model year 1996 and later), and heavier duty vehicles as standardized OBD systems become available on them.

This new OBD check will allow the emissions inspection program to keep pace with advances in vehicle technology. This is important because the Commonwealth has made substantial progress toward reducing air pollution by requiring that new vehicles sold here incorporate advanced emissions control systems. The OBD test will help protect the Commonwealth's investment in modern "low emissions" and "super low emission" vehicles by ensuring that their sophisticated computerized emissions controls continue to run properly over the life of the vehicle. In this way the OBD check will make a significant contribution to our long-term goal of achieving clean air for the Commonwealth's citizens.

## **2. What is OBD Testing ?**

Modern vehicles are equipped with computerized on-board diagnostic (OBD) systems that store information regarding engine performance, including information about a vehicle's emissions control systems. When a vehicle's sensors detect a problem, the OBD system sets a "fault code" and turns on the malfunction indicator light (MIL or "check engine" light) on the dashboard. OBD can be thought of as an electronic Environmental Management System for vehicles because its early identification of emissions control system malfunctions allows for earlier repairs of such malfunctions, ultimately preventing or reducing pollution.

Since model year 1996, EPA has required that the OBD systems of all light duty vehicles sold in the U.S. meet "OBDII" specifications ("OBD" in this document refers to OBDII). OBDII is a national standardized protocol for monitoring emissions control systems and for communicating information from the vehicle's computer to external test equipment for inspection or repair. Because OBDII is standardized, it is feasible to use in an emissions inspection. About 45-50% of Massachusetts' registered vehicles have OBDII. Less than 15% (about 500,000 vehicles) would receive the OBD test initially due to the 2-year new car and low emitter exemptions. This would rise gradually as more OBD vehicles are added to the fleet.

The OBD test involves finding the vehicle's standardized OBD connector and plugging the test equipment's adapter into it. The test equipment's computer then queries the vehicle's computer for emissions-related trouble codes in about 15 seconds.

While DEP believes that OBD is the best emissions test for modern vehicles, OBD cannot fully replace the tailpipe test for many years. Since older non-OBD equipped vehicles tend to pollute more, most of the program's benefit comes from emissions reductions on vehicles that pre-date OBD (model years 1984-95). As OBD vehicles become a larger portion of the Massachusetts fleet over time, OBD testing should gradually replace tailpipe testing. Because the current tailpipe test will continue to generate most of the program's emissions reductions over the next decade, we do not plan to phase out tailpipe testing for many years. Any phase-out also would assume that OBD is reliable and effective on older vehicles. If OBD should prove to be unreliable or ineffective, DEP would need to continue tailpipe testing.

## **3. Why Implement OBD Testing?**

The Massachusetts I&M program was designed to balance the interests of *environmental protection*, *motorist convenience*, and *compatibility with the auto inspection and repair industry*. OBD testing should be implemented because it provides substantial benefits for motorists, inspection stations, and the environment. As a long-term I&M strategy, we believe OBD will provide the best balance between environmental protection, motorist convenience, and cost.

- *OBD testing is much faster and more convenient than the current test.* This means motorists spend less time waiting for their inspection (or waiting in line for other motorists to finish theirs). The OBD test takes about 1-2 minutes compared with about 15 minutes for a dynamometer test (a 90+% improvement). For the great majority that pass the test, they will receive that good news 10 times faster. OBD testing will help reduce lines and wait times at the end of the month. We expect OBD to reduce overall statewide emissions test time by about 10-15% initially, and by more than 50% in 4 to 5 years.
- *OBD testing is more protective of the environment than the current test.* OBD is the next generation of emissions test. The current dynamometer test is designed to measure emissions while simulating normal driving conditions. OBD checks a vehicle's emissions control systems under actual driving conditions rather than a simulation because it is monitoring these systems continuously. Therefore, OBD can detect intermittent problems and problems under conditions that would not occur in the dynamometer test, such as highway speeds. OBD also monitors for malfunctions that will affect emissions when the vehicle is first started and cold. The current test was designed only to look at emissions when a vehicle is fully warmed up.
- *OBD is a more appropriate test for new low emissions vehicles.* OBD testing maintains our state's investment in modern cleaner vehicles by ensuring that their sophisticated controls are working properly. Since 1995, Massachusetts has made significant progress in reducing the emissions of new vehicles sold in the state through tighter new vehicle emissions standards. These low, ultra low, and super low emissions vehicles have complex emissions control systems that will provide significant reductions in pollution for many years to come, if they are maintained. The current dynamometer equipment was not intended to test such vehicles down to their low emissions levels. OBD, however, was designed specifically to help these vehicles sustain their performance. Thus, OBD testing is essential to maintain the full air quality benefits of modern cleaner vehicles into the future.
- *OBD checks vehicular pollution sources the current program cannot test.* OBD testing is more effective than the current test because it will check components the current test cannot. For example, the current evaporative inspection includes only a check of the gas cap. The OBD evaporative control check will cover the gas tank, fuel lines, and vapor recovery system in addition to the gas cap (leaky fuel systems not only increase air pollution, but they also cost a motorist money through reduced fuel economy).
- *OBD tests more types of vehicles.* OBD is the only way to fully test many new all-wheel-drive SUVs and traction control vehicles because these cannot be run on a dynamometer.
- *OBD testing helps protect motorists while protecting the environment.* The OBD "check engine" light provides an early warning of malfunctions that could lead to more costly repairs later. OBD is designed to find problems earlier than the tailpipe test, before they can become multi-component

failures that increase emissions and cost a motorist more to fix. For example, a misfire left undetected would dump too much fuel into the catalytic converter, which would then overheat and be damaged (potentially a very expensive repair on a new vehicle). Testing the vehicle's OBD system during an inspection will help protect motorists by alerting them to problems earlier, potentially before their warranties have expired or when they can take advantage of lemon law protections.

OBD also helps motorists save money on repairs because it provides information about the specific emissions defects present, which makes it much easier to accurately diagnose and repair those defects.

- *OBD testing will encourage motorists to be aware of the “check engine” light.* Responding to the “check engine” light can reduce emissions, improve fuel economy, and help save money on maintenance. Motorists may come to think of the OBD test as part of their vehicle's preventive maintenance plan. Many motorists may choose to go in for repairs as soon as the light comes on rather than waiting for their inspection, thereby reducing excess emissions even further.
- *OBD testing is a U.S. EPA requirement.* In April 2001, the United States Environmental Protection Agency (EPA) finalized its rule requiring enhanced I&M programs such as Massachusetts to start OBD testing by January 2002. DEP is beginning a phase-in of OBD testing to meet this requirement in part. Full implementation of the OBD test would be accomplished through these regulations revisions. These regulation revisions would constitute an amendment to the I&M State Implementation Plan (SIP), the document that describes DEP's commitment to run the I&M program to EPA.

#### **4. Proposed Revisions for the OBD Emissions Test**

In the draft regulatory revisions, DEP proposes to inspect the OBD systems of light duty gasoline vehicles model year 1996 and newer, medium and heavy duty gasoline vehicles model year 2002 and newer, light duty diesel vehicles model year 1997 and newer, and medium duty diesel vehicles model year 2005 and newer. The OBD test would be given instead of using the current tailpipe tests, with a few exceptions. The OBD test may be supplemented with the appropriate tailpipe test when the vehicle's OBD systems are not all ready for testing, a condition that will occur in a very small number of vehicles. The same repair requirements and penalties would apply to vehicles failing the OBD test as to those currently failing the tailpipe tests.

DEP hopes to begin OBD testing in late 2002. The start date for beginning inspections using OBD is dependent on the program's network contractor developing software that can successfully implement the OBD test with as few “bugs” and shortcomings as possible. Having robust software for the OBD test is crucial for a smooth rollout of the new test. Therefore, DEP may delay the start of OBD testing for a short period to ensure proper operation of the test equipment and network.

## **5. Other Proposed Changes**

Other proposed revisions in this regulatory package include the following:

1. changes to ensure the emission inspection cycle, which is intended to require an emissions test at least every two years, does not extend beyond two years;
2. changes to clarify the scheduling of emissions tests now that the initial startup years of the program have passed;
3. changes to require the inspection sticker to show the month and year for the next inspection for easier reading by the motorist and to assist with on-road enforcement; and
4. changes to provide for an automatic renewal of emissions inspector certificates to reduce administrative costs associated with renewing such certificates.

## **6. Public Comment Requested**

The DEP is seeking public comment on all components of the proposed regulations included in this package. In particular, DEP requests comment on whether to subject diesel vehicles (between 8500 and 10,000 GVWR) to an opacity test or an on-board diagnostic system test. The DEP will submit the regulations and other supporting documents to EPA as a revision to the Massachusetts I&M SIP.

The DEP will hold two public hearings on September 26, 2002, one at Massachusetts Bay Community College in Wellesley and one at DEP's Western Regional Office in Springfield at 7:00 p.m. to receive public comment, on its proposed revised regulations. Comments may be presented orally and/or in writing at the public hearings. Parties are requested to provide three written copies of their comments. Comments will be accepted until close of business on September 30, 2002. Written comments must be submitted to:

Mark Wert  
Department of Environmental Protection  
One Winter Street, 9<sup>th</sup> Floor  
Boston, MA 02108

It would be helpful if comments were also submitted electronically to [mark.wert@state.ma.us](mailto:mark.wert@state.ma.us).

## **7. Regulatory Impacts on Policies, Programs, Orders, and Acts**

### *Source Reduction Policy*

In January 1988, DEP issued a policy memorandum requiring divisions within DEP to assess the impact of all new regulations on source reduction by organizations and individuals. Source reduction by organizations is defined as in-plant practices which reduce the mass of environmental contaminants discharged to the land, air, or water. Individual source reduction is defined as practices that reduce the mass of pollutants discharged by individuals during the course of their daily activities.

The 1999 enhanced vehicle inspection and maintenance program was designed to reduce emission levels of in use light duty vehicles and light duty trucks by administering a more accurate test designed to simulate actual driving conditions. The revisions proposed today should further enhance the source reduction potential of the inspection program because the on-board diagnostic system test will find problems the current test will miss and can find them earlier thereby allowing greater overall reductions in pollution from on-road vehicles.

### *Executive Order 145*

Pursuant to Executive Order 145, DEP must assess the fiscal impact of new regulations on the state's municipalities. This Executive Order was issued in response to Proposition 2-1/2, G.L. c. 29 s.27C, which requires the state to reimburse municipalities for costs incurred as a consequence of new state laws and regulations. Since municipal vehicles were subject to the previous vehicle inspection program, which was in effect prior to January 1, 1981, costs imposed by the new I&M program, and thus the proposed revisions, are not new costs “due to the imposition of new direct services or costs”; nor are they mandated costs unavoidable by the municipality; they are “incidental local administration expenses.” Therefore, any inspection and repair costs are not subject to the restrictions of G.L. c. 29 s. 27 (c).

### *Massachusetts Environmental Policy Act (MEPA)*

Pursuant to 301 CMR 11.00 et seq. (Massachusetts Environmental Policy Act Regulations (MEPA)), this action does not require filing of an Environmental Notification Form (ENF) since the regulations as proposed do not trigger any of the MEPA review standards. In fact, the proposed revisions to the existing regulations increase the protection to the environment.

### *Agricultural Impacts*

The only impact on agriculture will be beneficial, as the program will help Massachusetts to attain and maintain both the primary and secondary National Ambient Air Quality Standards (NAAQS) for ozone, thus lowering crop damage attributable to high ozone concentrations in the summer.



## *Public Participation*

As required by state law, DEP gives notice and provides the opportunity to review background and technical information at least 21 days prior to proposing a regulation or amendment at a public hearing. Formal notice for the proposed revisions will be issued 30 days before the public hearing to assure the greatest opportunity for full public participation in processing a rule as an amendment to the SIP.

## **8. Federal Requirements**

The Clean Air Act as amended in 1990 (CAA) requires the Environmental Protection Agency (EPA) to set guidelines for states to follow in designing and implementing vehicle inspection and maintenance programs. On November 5, 1992, EPA issued final rules implementing Section 182 of the CAA amendments of 1990. Section 182 of the CAA amendments addresses vehicle inspection and maintenance programs. EPA's rules constitute binding regulations that must be satisfied by states when applicable.

The 1992 final rules did not include standards for OBD testing requirements, but on August 6, 1996 EPA amended the 1992 rule establishing OBD performance standards and the requirement that OBD testing be included in enhanced I&M programs. At that time in 1996, it was not practical to evaluate real-world, in-use performance of OBD because the vehicles in question were still too new and the numbers of those vehicles in need of repair were too few to make pilot testing for EPA worthwhile. So, on May 4, 1998, EPA amended its OBD testing requirements to delay the date for implementing OBD to January 1, 2001. EPA then amended its rule again on April 5, 2001. See, 40 CFR 51.351 et seq and 40 CFR 85.2207 et seq. The final rule revised the performance standard for OBD tests to:

1. extend the deadline for beginning OBD inspections to January 1, 2002;
2. allow states showing good cause up to an additional 12 months' delay;
3. revise the failure criteria for the OBD test; and
4. allow for limited exemptions from some OBD test failures.

The proposed regulations and SIP revisions are intended to meet the requirements of EPA's current regulation.

## **9. OBD Cost Benefit Analysis**

This paper discusses the costs and benefits associated with this revision to the inspection program. The relative costs and benefits of the enhanced automobile emissions inspection and maintenance program,

implemented in October 1999, are discussed in a paper accompanying the regulations for the enhanced inspection program.

### *Direct Costs*

There are two main direct costs of switching to an OBD test: the direct cost to conduct the OBD test instead of the transient loaded mode test on certain vehicles and the cost of repairs that will be incurred to fix vehicles that fail the OBD test. These costs are discussed below in the context of the additional or incremental cost of the revised program in comparison to the current enhanced program.

### *Direct Inspection Costs*

Direct cost of the inspection appears to vary widely between shops based on geographic location, whether the inspection shop is test-only or also does repairs, and the volume of inspections performed. For purposes of this analysis we assume a shop labor rate of \$70 per hour.

Vehicles 1995 and older, which are not equipped with OBD II systems, would continue to receive the dynamometer test. Vehicles 2 years old and newer would continue to be exempt from any emissions test, as would vehicles model year 1983 and older. Further, about 1 in 2 OBD II equipped vehicles (1996 and newer) are exempt from the emissions test as part of a Clean Screen. The Clean Screen exempts vehicles from the emissions test based on Massachusetts' and other states' information indicating that those particular engine types and models tend to fail emissions testing rarely. The Clean Screen is adjusted periodically, so the mix of vehicles exempted changes over time.

About 500,000 OBD II equipped vehicles of model year 1996 and newer are subject to the dynamometer test once every two years. This analysis therefore focuses on the 250,000 vehicles per year that would receive an OBD test instead of a dynamometer test.

	<b>Current Program dynamometer tes</b>	<b>OBD</b>	<b>Difference</b>
Time for emissions inspection	12 –15 minutes	½ - 2 minutes	10 – 14 ½ minutes
Time spent on inspection	3,000,000 – 3,750,000 minutes	125,000 – 500,000 minutes	\$2.9 million to \$4.2 million less annually with OBD

\* uses a Shop Rate of \$70 per hour and 250,000 vehicles per year

This savings accrues to the inspection stations and amounts to about \$0.50-\$1 per motor vehicle inspection initially. It will, over time, help address the concern that inspection stations have regarding the inability of the current fixed inspection fee to adjust for inflation over the long-term without the need for any increase in fee to the motorist. Motorists also benefit from the time savings, however no monetary estimate of that benefit's value is given here.

#### *Direct Repair Costs*

There are two components needed to calculate Direct Repair Costs: failure rate and average cost of repairs. Since the OBD system is designed to be more stringent than the dynamometer test, failure rates will be higher. For purposes of this analysis we assume a 1-3% dynamometer failure rate and a 3-5% OBD failure rate.

Average repair cost data for vehicles in the current program is approximately \$250. Average repair costs with an OBD test are assumed to be the same, because data from EPA indicate that any higher costs in repair for newer, OBD equipped vehicles are offset by the lower cost of both shorter time for diagnosis and higher accuracy of repairs (i.e., fewer customer returns) from the more accurate OBD-based diagnoses.

	Current Program dynamometer tes	OBD	Difference
Average Cost of repairs	\$250	\$250	
Number of vehicles	2,500 – 7,500 vehicles annually (1 – 3%)	7,500 – 12,500 vehicles annually (3 to 5%)	
Cost	\$0.625 million – \$1.875 million	\$1.875 million - \$3.125 million	\$0 - \$2.5 million more annually with OBD

These costs accrue to those motorists whose vehicles fail the inspection (i.e., those whose vehicles are malfunctioning).

#### *Other Cost Factors and Issues*

The savings from reduced inspection time will increase over time as 1996 and newer vehicles make up a greater percentage of the fleet. The cost of additional repairs for malfunctions found by OBD, however,

will also increase over time as the percentage of OBD-equipped vehicles increases. Data describing the eventual failure rates for highly aged OBD vehicles is incomplete, and may not be reliable at this time. EPA is continuing to study this question.

Some marginal increase in warranty coverage of repairs is expected with OBD. Currently vehicles 3 years and older that are exempt from the emissions test do not have a state-sponsored opportunity to determine whether components of the emissions control system are malfunctioning. We assume that some of the malfunctions found by OBD will be repaired under warranty at no or reduced cost to motorists, thereby reducing the overall cost of repairs.

#### *Total Program Costs*

Changing to an OBD test results in net savings of from \$0.4 million to \$4.2 million (savings from the inspection minus increased cost of repairs). In other words, the savings in inspection time from OBD outweighs the increased cost of repairs overall.

#### *Direct Program Benefits*

The primary benefit that can be achieved by implementing OBD testing is the health and environmental benefits from air pollution reductions. The dollar value of these benefits is discussed below.

EPA credits the Massachusetts dynamometer test with achieving 85% of the effectiveness of its “gold standard” test, the IM240. EPA will apply no such discount to the Massachusetts OBD test because the Massachusetts OBD check is not different from that modeled by EPA, and EPA credits OBD testing and IM240 testing equally. Therefore the Massachusetts program will receive at least a 17% increase in effectiveness credit for vehicles that are subject to the OBD test (15%/85%). EPA will also provide additional credit for the OBD check due to the heightened stringency of the test design and the ability of the OBD test to check a greater range of emissions control components over a much wider range of operating conditions than a tailpipe test.

With about 4 million vehicles subject to inspections and 500,000 vehicles switched from the dynamometer test to the OBD test, approximately 13% of Massachusetts vehicles would be subject to the OBD test at this time.

Using the cost benefit figures from the 1997 regulations for the current program (see footnote <sup>1</sup> below) and the EPA credit figures, the number of additional tons reduced can be calculated as follows:

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<sup>1</sup> *The Emissions Check-up program is projected to provide 33% of the Volatile Organic Compounds (VOC) reductions and 25% of the oxides of nitrogen (NO<sub>x</sub>) reductions that will be achieved by the State in complying with the CAA. VOC and NO<sub>x</sub> combine in the presence of sunlight to create ozone. Massachusetts is in violation of minimum federal standards for ozone. This will result in a permanent emission reduction of 1,815 tons per year of VOC and a permanent reduction of 16,250 tons per year of NO<sub>x</sub>.*

Current Program : dynamometer test		OBD	Difference
Increased effectiveness of OBD test		~2% increase in overall effectiveness (17% increase in effectiveness for 13% of the fleet)	
Annual Pollution Reduced	18,065 tons of oxides of nitrogen and volatile organic compounds	~ 18,426 tons of oxides of nitrogen and volatile organic compounds	~ 361 additional tons of oxides of nitrogen and volatile organic compounds

EPA has published figures describing the value of each ozone-producing ton of pollution reduced. Using the EPA figure of \$33,600 per ton (in 1990 dollars) , the benefit of switching to the OBD program is \$12.1 million in avoided health care and other costs, calculated by multiplying tons reduced times the benefit figures provided by EPA (see footnote <sup>2</sup> below).

Over time, there will be a steady increase in the number and percentage of vehicles 1996 and newer. By the end of the decade we estimate that over 90% of the vehicles on the road in Massachusetts will be 1996 and newer vehicles. Therefore, the immediate 2% increase in effectiveness will increase over time.

#### *Additional Program Benefits*

Since OBD provides an early warning of emissions control component failure, it tends to fail vehicles before those vehicles would fail the tailpipe test (i.e., before they become gross polluters). Thus, some

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*From a cost-effectiveness standpoint, the cost per ton to achieve these reductions is between \$1,327 and \$2,932 per ton, which is calculated by dividing the \$24 million to \$53 million per year range of cost estimates from above by annual pollutant reduction levels for VOC and NO<sub>x</sub> of 18,075 tons. This range is consistent with cost per ton figures from other states and the EPA and with other air quality programs implemented by DEP in the past 10 years.*

<sup>2</sup> *The average dollar value of health and environmental benefits received by sustained reductions of these pollutants is \$33,600 per ton reduced based on EPA's review of studies performed on the topic. On an annual basis, this translates into a benefit of \$607 million per year (\$33,600 per ton times 18,075 tons per year). The quantified benefit is chiefly projected based on reduced incidents of death and sickness resulting from respiratory and heart ailments, although as EPA points out, a wide variety of additional health and environmental benefits will be achieved by reductions of these pollutants.*

vehicles that would have not had any repairs under the tailpipe test would instead need repairs to pass the OBD test thereby preventing additional pollution from entering the environment. We anticipate that this effect will be significant.

The dashboard OBD light may prompt motorists to have their vehicles checked independent of their inspection requirement. To the extent that OBD-indicated malfunctions are repaired before the vehicles produce emissions that grossly exceed their design standards, there will be additional pollution reductions.

Auto manufacturers will produce vehicles that meet increasingly more protective new vehicle tailpipe standards throughout the rest of this decade. The OBD systems on those vehicles will be designed to account for these much lower emissions standards. Thus, the OBD test offers a no-cost means of allowing the emissions inspection program to keep pace with changes in vehicle technology in the future.

#### *Benefits Summary*

Switching to an OBD test will provide \$12.1 million in annual benefits, which will increase over time. There are likely to be additional unquantified benefits resulting from more timely vehicle maintenance. As with any vehicle inspection program (and many environmental programs) the cost is borne by the sources of the pollution (i.e., owners of vehicles that have malfunctioning emissions control systems) while the benefits accrue to a larger population.

#### *Comparison of Costs and Benefits*

Switching to an OBD test will create benefits that exceed costs by approximately \$12.5 million to \$16.3 million annually.